OPEN REDUCTION AND INTERNAL FIXATION IN PEDIATRIC MANDIBULAR FRACTURES

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DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY

CERTIFICATE

This is to certify that this dissertation entitled **"Open Reduction And Internal Fixation In Pediatric Mandibular Fracture "** is a genuine work done by **Dr. Meenakshi Chauhan Rana** under my guidance during her post graduate study period between 2009-2012.

This Dissertation is submitted to THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY in partial fulfillment for the Degree of **MASTER OF DENTAL SURGERY IN ORAL AND MAXILLOFACIAL SURGERY, BRANCH III.** It has not been submitted (partial or full) for the award of any other degree or diploma.

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Date :

Kavalkinaru

Dedicated To

My Dear Husband
Major Aditya Singh Rana,

Parents, in-laws,
&
My Loving Daughter
Advika

Acknowledgment

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CONTENTS

INTRODUCTION

INTRODUCTION

Maxillofacial fractures in the pediatric age group are relatively uncommon, yet they are no less important .The impact of craniofacial trauma in pediatric population is minimized due to the light weight and small size of the facial skeleton. The force of impact is absorbed by the forehead and the skull rather than the face since the ratio of cranial volume to facial volume is greater in children than adults (8:1 at birth ,4:1 at 5 years, versus 2:1 in adults)[59] .Pediatric facial bones are more resistant to fractures due to

Higher elasticity,

Poor pneumatization by the sinuses,

Thick surrounding adipose tissue and

Stabilization of the mandible and maxilla by the unerrupted teeth.

Excluding the nasal bones, the mandible is the most frequently fractured facial bone in the pediatric patients .One third of pediatric trauma patients with facial fractures have mandibular fracture.

The treatment of pediatric mandibular fractures is controversial and complicated by many factors such as:

Tooth eruption,

Short roots,

Developing tooth buds and

Growth especially at the mixed dentition stage.

Rigid fixation is a technique used in the management of facial fractures that has developed for more than 20 years[9]. However, use in children is somewhat controversial. Many studies have been done on infant animals showing the plate fixation across midfacial and cranial sutures lines have resulted in growth retardation along these suture line. Since these studies were performed on infant animals with rapid facial growth patterns, it was difficult to draw firm conclusions with regard to human children. But these studies did highlight the fact that rigid fixation should be used cautiously in children. If proper reduction of facial fractures is not achievable by other means, rigid fixation should be performed because the alternative of improper correction is unacceptable.

The goals of treatment should be

An accurate reduction,

Three dimensional restorations of pre-injury form and functions.[14]

If it requires rigid fixation with plating, then this must be done using monocortical screws at the inferior border of the mandible to avoid damaging the underlying teeth.

The commonly used osteosynthesis technique for the fixation of adult parasymphysial fractures is to use two miniplates, one at the inferior border of the mandible and the other above it as a tension band to withstand the torsion forces in this area of the mandible[4]. Many factors make closed reduction difficult fractures in pediatric mandibular fractures.

1. The child is more difficult to examine both clinically and radiologically.

2. It is more difficult to make use of the teeth in children for fixation, because deciduous teeth may be either insufficient in number or their roots may be resorbed and permanent teeth may be incompletely erupted.

3. The shape of the deciduous crown is also not favorable for retention of wires and splints, being bell-shaped with little undercut area.

4. Elasticity of the bone in children,

5. The relatively small size of the face,

6. The growth process in the young bone is also among the factors that influence the pattern of fracture and its management.

7. The postoperative period of fixation.

Ankylosis of the temporomandibular joint causing impairment of function is more common in children and damage to the condylar growth centre can result in facial deformity.[15]

Discrepancies[14] in alignment and occlusion are often corrected by the natural remodeling of the bone. In general, pediatric maxillofacial fractures are managed according to the same basic principles applied in adult fractures. However, because of the specific aspects related to the pediatric dentition and to certain anatomical differences mentioned above conservative approach in the treatment of maxillofacial trauma in the pediatric age group may not produce the best possible outcomes.

During the past three decades, there have been considerable advances in the prevention, diagnosis and treatment of craniomaxillofacial (CMF) injuries. Preventive legislation (speed limits, alcohol restriction, use of helmets, shoulder and seat restraints), improved road construction measures and vehicle safety modifications (safety glass, padded dash boards, stronger frames, collapsible steering columns, airbags) have led to a

significant decrease in the incidence and severity of road traffic accidents (RTA) in some countries. Imaging techniques such as Computed Tomographic (CT) scanning with three dimensional reconstructions have been developed and improved. They provide the fine, unobstructed anatomic detail required to guide surgeons in achieving accurate reduction of fractures, especially in the midface region. The introduction of rigid internal fixation into CMF surgery has revolutionized the treatment of facial fractures by allowing accurate reduction and fixation of bone fragments, stable three-dimensional reconstruction and by reducing the need for prolonged maxillomandibular fixation. Finally, improvements in airway, metabolic and anesthesia management have also helped to improve the outcomes for pediatric patients who suffer Craniomaxillofacial injuries. This dissertation focuses on the assessment, evaluation and treatment of mandibular fracture in young children by Open Reduction and Internal Fixation.

TRAUMA RELATED EMBRYOLOGY

Trauma Related Embryology

Mandible is the second bone to ossify (next to clavicle) in the body .The mandible has right &left halves at birth united in the midline with fibrous tissue called the symphysis menti which may have disappeared at birth. Ossification is complete within the first year after birth.

AGE CHANGES IN THE MANDIBLE:-

At birth: The angle of the mandible is obtuse. The condylar head is at the level of the coronoid process. The two halves of mandible are united by symphysis menti. The bodies of the mandible have enclosed sockets of deciduous teeth. The mandibular canal is near the lower border, the mental foramen opens below the first deciduous molar.

At 3 years: The two halves join at symphysis from below upwards. The body elongates especially behind the mental foramen therefore cycating space for 3 teeth. During the 1st and 2nd year, as chin develops the mental foramen alters direction from anterior to poster superior and almost horizontal position as in adults.

At 6 years: There is a vertical increase in the ramus height to the general mandibular growth of downwards and forwards. As depth of body increases alveolar growth makes room for the roots. After eruption of permanent teeth the mandibular canal is little above the mylohyoid line and the mental foramen occupies the adult position. As the mandible increases in size, bone is added at the posterior borders of ramus and coronoid process and resorption occurs at anterior borders. The angle becomes more right angle.

In Adults: Alveolar and sub-alveolar regions are about equal in depth, the mental foramen is midway and the mandibular canal is parallel to the mylohyoid line. The angle is right and condyle lies above the coronoid process. The ramus height increases with age.

In the mandible , labial walls are thin in the incisor and canine region ,the lingual wall in molar regions .The mandibular alveolar ridge is within the line of teeth but outside in molar regions forming a curve wider posteriorly but intersecting in premolar region. Increase in the width of the face occurs as the mandible widens.

Muscles of facial expression have no influence on the movement of fracture segments .The muscles on the lingual aspect and ramus of the mandible on the other side have a tendency to pull fracture segments away from each other.

For the successful evaluation and management of maxillofacial trauma in pediatric group a thorough knowledge about the embryologic origin, development and its anatomic differentiation from the adult is mandatory

The mandible is the facial bone most frequently involved in post-traumatic malformations. Embryologically, the dorsal part of the first mandibular arch, becomes chondrified, forming a small cartilaginous mass that represents the pterygoquadrate bar of lower vertebraes. The remaining ventral and much larger portion of the pharyngeal arch chondrifies to form Meckel's cartilage

Later in development, two membranous bones are laid down on the outer side of Meckel's cartilage. The most anterior of these, which appears early, is related to the lateral aspect of the ventral portion of the cartilage and forms of mandible.

At first it is a small covering of membranous bone. However by growth and extension it soon surrounds Meckel's cartilage, except at its anterior extremity, where endochondral ossification occurs .Upward growth forms the mandibular ramus at the posterior end of the developing mandible. This portion of mandible comes into contact with the squamous portion of the temporal bone to form the temporomandibular joint, in which a fibrocartilaginous articular disc develops. Part of the ramus of the mandible is transformed into cartilage before cartilage ossification occurs.

The mandible, small at birth, is destined to grow both by bone growth and by development of the alveolar process which accompanies teeth development .The recognition of condylar growth centers showed that the forward projection of the mandible is a consequence of this posterior border of the ramus. Posterior appositional growth is only one of many movements associated with total mandibular growth as all the different portions of the bone participate in the growth process. In addition to the centers of growth, increase in size is the result of surface apposition, the local contours of the, mandible constantly undergoing changes as a result of remodeling resorptive, and depository activities.

Growth of the condyle is the result of endochondral ossification in the epiphysis. The role of trauma is particularly important to the condylar articular cartilage in that it may result in mandibular hypoplasia, particularly if the trauma occurs before the age of 5 years.

Blood supply of the mandible is via the sources, central and peripheral. Central is endostium through the inferior alveolar artery and peripheral is through the periosteal blood vessels.

Surgical Anatomy

SURGICAL ANATOMY

INTRA ORAL APPROACH

Intra oral approach to the mandibular body and symphysis is done through a vestibular incision and reflecting a mucoperisoteal flap. The reflection should extend to the inferior border as the screws have to be placed at the inferior border so as to prevent damage to the underlying tooth buds.

EXTRA ORAL APPROACH

Extra oral approach is done in cases of mandibular angle fractures when intraoral approach will not permit perpendicular fixation of the screws. Access is obtained through a submandibular incision. Important landmarks are the corner of the mouth and the ear lobe. Skin incision is made in relaxed skin tension line 1cm below the inferior border of the mandible to prevent injury to the marginal mandibular nerve. Cross hatching of the incision can be performed to simplify the closure. The skin and subcutaneous tissues are incised with a scalpel down to the level of platysma, and undermining the skin to allow improved retraction is obtained with scissors. The platysma is sharply divided exposing the superficial layer of deep cervical fascia. Undermining of the platysma is

done with the haemostats before dividing. It helps in protecting the marginal mandibular branch of the facial nerve which is located within or immediately deep to the superficial layer of deep cervical fascia. Division of this layer is accomplished with a combination of sharp and blunt dissection at the level of the original skin incision. The dissection continues towards the mandible and division of the periosteal layer is done at the inferior border of the mandible. Closure is completed in four layers; - periosteum, platysma subcutaneous tissue and finally skin.

Review of Literature

REVIEW OF LITERATURE

"Patient and kind handling, of these injured children will usually assure cooperation and an all together satisfactory union of fractures." This advice by Waldron ET AL in 1943 is still valid today.

The oldest record of treatment of jaw fracture according to Kruger and Shilli[15] is found in the Egyptian Edwin Smith papyrus in the middle of the 16th century B.C. In each case, the diagnosis & prognosis as well as the verdict are dealt with. The verdicts were of three kinds "an ailment to be treated", "an ailment I will content with" & "an ailment I will content with" & "an ailment not to be treated". This point of view of giving up cases held to be hopeless was typical of the ancient physicians.

Thoma while tracing the history of the management of jaw fractures stated that the first clean therapeutic guide lines were found at the turn of the first century B.C. in the works of Hippocrates who recommended immobilization of the reduced fragments with the use of gold wire or linen thread.

Thoma quotes Bunon (1943)

As the first person to use dental prosthesis for fractured mandible. During the 19th century numerous splints were devised, the most popular being that of Gunning

Bean&Thoma(1865)refers to this period a **"PROSTHETIC ERA"** in fracture management.

According to **Wald** the earliest attempt of using screw plate system to stabilize jaw fracture was made by **Hausmann**(1865).

KRUGER (1964)[26]

Felt that open reduction with internal fixation was a definitive method of anchoring bone segments at the fracture site. He stressed the need for additional inter maxillary fixation.

BEATROUS (1968)[6]

Airway management in pediatric group has advanced considerably. In the 1950s and 1960s the incidence of tracheostomy in children increased significantly.

ROWE (1968)[43]

Reported that because of tremendous healing capacity children required only a shorter period of inter maxillary fixation.

MICHELET ET AL (1973)[30]

Was the first person to introduce monocortical osteo-synthesis that would guarantee fracture healing without IMF and without compression. The miniaturized plates showed excellent results, ensuring perfect adaptation of the osseous fragments, restoration of occlusion and reduced period of IMF. He showed that the mandible can be approached through intraoral route so that there is no external scar or injury to the mandibular branch of the 7th nerve.

WILLIAM C. MORGAN(1975)[58]

Reported thecauses, LocationMale –Female ratio,Occurrence of multiple fractures, and associated problems in pediatricmandibular fractures.

KABAN LB, MULLIKEN JB, HURRAY (1977)[24]

Reported short term endotracheal intubation and fibro-optic laryngoscopy had replaced tracheostomy as a predominant type of airway management. They advocated conservation in the management of minimally displaced fractures especially in younger individuals.

CHAMPY ET AL (1978)[9]

Modified the technique,he introduced ideal osetosynthesis line corresponding to the morphology of the mandible which allowed a true tension banding system to be established.

REITZIK AND ASSOCIATE (1983)[39]

Compared the influence of rigid with semi-rigid fixations after experimental mandibular fractures in monkey. They found that the entire semi-rigid fixation resulted in more external callous formation after 6 weeks, rigid fixations producing a denser and stronger bone scar. The rigid sides were twice as strong as semi-rigid sides, in spite of the fact that the semi-rigid sides had a 50% greater cross-sectional area.

HUNSUCK (1984) [19]

Described in detail the method of intra-oral open reduction of the fractured mandible. He too stressed the avoidance of facial nerve and scarring subsequent to the external approach.

Amaratunga(1988)[2]

Conducted a study on mandibular fractures in children and has advocated that because of a rapid callous formation in children only two weeks of immobilization is required if treated by close reduction and fixation.

Klotch D (1988)[25]

Suggested that the decisions regarding management of mandibular fracture are based on

1. age of the child
2. dentition
3. the site of fracture
4. fracture pattern
5. relation of fracture pattern to muscular forces

6. fracture stability
7. fracture severity and associated mid-facial fractures

He also suggested that unstable and unfavourable fractures may be treated with newer techniques of plating through intral-oral incision.

Jones K.M, Bauer, and Pensier JM (1989) [22]

Conducted a study on pediatric mandibular fractures and advised the use of open reduction and intraosseous wiring where the fracture segments are excessively displaced. They felt that monocortical screws and miniplate fixation as either being too difficult to place or reserved for older age groups.

HALLING F, MERTEN H A, LUHR IN 1990 [16]

Has treated 30 out of 36 mandibular body fractures with plate fixation, predominantly minicompression plates. They found the advantage being immediate functional treatment for possible condylar fracture and no postoperative inter maxillary fixation required. Hence they recommended rigid plate fixation of mandibular fracture in children.

NIXON F & LOWEY MN (1990)[32]

Reported that the disadvantage of any open reduction with internal fixation in pediatric patients is a increased possibility of damage to developing tooth buds. This complication can occur with both wire and screw fixation causing failed eruption of permanent tooth. The developing canine tooth was the most likely tooth to be damaged.

BECKY L.MC GRAW (1990)[7]

Reported differences in fracture characteristic, associated injuries, and treatment modalities were correlated to the maturational changes in the pediatric facial skeleton. The site tended to shift from the upper to the lower aspect of the face with increasing age of the patient. Associated injuries were frequent, especially cranial injuries, and temporal bone fractures were notably more common in the youngest age group, because of the unique remodeling potential of the pediatric facial skeleton.

MICHAEL B.SIEGEL ET AL (1991)[29]

A trend toward greater number of fractures and a predominance of male is shown with increasing age. Child abuse is a relatively frequent

cause of fractures throughout all groups. Associated injuries are more common in young children. The high osteogenic potential of the potential of the pediatric mandible allowed conservative management to be successful in 25% of younger patients and was responsible for a low complication rate overall.

TAMARI.K. AND ASSOCIATES (1991)[53]

Found in their study that incomplete management of mandibular fractures results in persistent deformation of mandible, disturbance of dental occlusion and difficulty in mastication.

MARX ET AL (1992) [28]

Commented that fixation plates in pediatric patients may actually become encased in new bone. The placement of wire, miniplates or screws would result in little or no harm in growing bone.

BERG S. PAPE HD (1992)[8]

Had treated patients with mandible fracture in which the tooth in line with fracture line was treated by means of Champy's miniplates. It was

found that only rarely did the "salvaged tooth" subsequently require extraction.

WONG GB (1993) [59]

Suggested that closed reduction with inter maxillary fixation in very young children can cause several concerns including cooperation, compliance and adequate nutritional intake. Rigid internal fixation of unstable mandible fractures using miniplates and screws circumvents the need of inter maxillary fixation and allows immediate jaw mobilization.

POSNICK JC, PRON G (1993) [37]

Conducted a study review in the treatment of facial trauma and found that 75% of patients with acute trauma required operative intervention. In most of the cases plate and screw fixation was a preferred method of stabilization. He also advocated the use of miniplate and screw fixation in pediatric facial fracture requiring open reduction. These rigid internal fixation techniques were the most common methods of stabilization followed by wire fixation.

ROSENBERG (1993) [42]

Reported in which metal deposition were found in the direct neighborhood of titanium microplates and miniplates or in peripheral organs following osteosynthesis. Size and amount of osteosynthesis material used therefore be minimized as much as possible .The general rule in surgery , namely that " as little alloplastic material as possible but as much as necessary" should therefore is applied .

HARDT N, GOTT SAUNER (1993) [18]

Conducted a study on treatment of fractures in children based on the stage of dentition, site of fracture and displacement of tooth bearing part of mandible in early stages of dentition with undisplaced fractures. The treatment rationale includes inter maxillary fixation, by specially designed miniarch bars. The indication for miniplates osteo-synthesis is limited to displaced or multiple fractures of tooth bearing part of mandible. Correctly applied miniplates neither injure the tooth germ nor lead to growth disturbance of mandible.

TANAKA N (1993) [54]

On maxilla-facial fractures in children. The incidence was found to be 14.7% and highest incidence involved boys over 13 years of age. Fracture of upper alveolar bone and mandibular are common. Conservation therapy such as inter maxillary fixation using orthodontic brackets was found to be successful in such cases.

NORHOLT ET AL (1993) [33]

Reported, the risk of facial growth disturbance in Open Reduction and internal fixation has not been supported. He also found that as in adult population minimal reduction and fixation in communited fractures, displaced facial fractures in children it will result in malunion, contour defects and secondary reconstruction will be needed to correct residual deformities.

ANDERSON PJ (1995) [3]

Conducted a study in which the analysis of fracture patterns showed that despite differences in anatomy the fracture patterns were similar to

those occurring in adults but the relative proportion of each fracture type was different in children.

STEINHART H (1995) [49]

Conducted a study to assess the necessity of removal of osteosynthesis plate in area of facial skull and in children the osteosynthesis plate were only needed to be removed from the maxillary sinus wall and the alveolar ridge.

OJI (1998) [34]

Reported in his study that falls and traffic accidents were two major causes of fractured mandible in childrens.

SUDESHNI NAIDOO (2000) [51]

1) under 2- year of age children were most at risk from abuse
2) The number of the reported injuries to the oral cavity was extremely low.

Richard H. Haug ET AL (2000) [40]

The majority of injuries are encountered by boys who are involved in motor vehicle accident .the incidence of other systemic concomitant to facial trauma is significant. The management of the pediatric patient with maxillofacial injury should take into consideration the difference in anatomy, physiology and psychology and the specific injuries and anatomic site that the injuries affect.

Steven P.Davidson (2001) [50]

Free hand reduction is a valuable technique to reduce operative time for pediatric mandible fractures. It maximize return to function while minimizing the oral hygiene issues and hardware removal of intermaxillary function the potential damage to tooth roots and follicles can be minimized with a careful technique which places bicortical screws in the lower mandibular border with monocortial screws placed in more superior plates.

Feller ET AL (2002) [13]

In his study found the use of one miniplates with 1.5 monocortical screws at the inferior border of the mandible with a dental tension band appeared to maximize the advantages of an ORIF technique without any risk of injuring the teeth buds and without affecting the stability of the fracture fixation .The undisturbed stability of the fractured segments although fixed by microplates could be explained by understanding that fracture healing is a dynamic process in which masticatory forces are slowly intensifying carried by the healing bone.

Marianowski Remi ET AL (2003) [27]

Reported treatment of mandibular fractures in children is usually less aggressive than in adults. Traffic accidents are at risk of complication because of the mechanism of the traumatism usually brings associated injuries and surgical treatment is advised.

Ferreira, Pedro Costa (2004) [12]

Reported motor vehicle accident was the most common cause of fractures .the condyle of the mandible was the most common site maxillomandibular fixation was used with no complications.

Smart JM ET AL (2005) [48]

Reported mandibular growth provides the basis for normal occlusal relations and the generation of increasingly large masticatory force. The exact mechanism of bone remodeling during mandibular development remains unclear, the process likely receives contributions from primary growth centers and the responses to local alterations in biomechanical force produced by surrounding soft tissues structures.

Rudolf R.M. (2005) [45]

Metallic fixation for pediatric patients is ideal, they are easy to handle, easy to sterilize. They have better mechanical properties and small dimensions at the same time. They also reported that bioresorbable osteosynthesis system not much used because

insufficient clinical scientific evidence about the mechanical properties .handling of bioresorbable plates can be Difficult to sterilize and careful handling is needed.

Barry L. Eppley (2005) [5]

Reported resorbable polylactic and polyglycolic acid plates and screws can be an effective fixation method for facial fractures in children in the primary and secondary dentition periods.

KaanC.Yerit ET AL (OOOO 2005) [23]

Reported pediatric patients benefit from the advantages of resorbable materials, especially from faster mobilization and the avoidance of secondary removal operations. Based on these preliminary results, self reinforced fixation devices are safe and efficient in the treatment of pediatric mandible fractures.

Zimmermann ET AL (2005) [60]

Reported resorbable plates were applied only in cases without major displacement and were not used in cases of mandibular

angle fractures. Maxioll-mandibular immobilization, more difficult in children than in adults due to the mixed dentition, was not usually required as masticatory forces are less in children and do not compromise the fractures fixation. IMF was selectively applied in only a few cases of bimaxillary fracture, in severely displaced factors and in young adolescents who have strong masticatory forces. The method of open reduction and fixation of fractures.

Das ET AL (2006) [10]

Pediatric bones are more resistant to fractures due to their higher elasticity, poor pneumatization by sinuses, thick surrounding adipose tissue, and stabilization of the mandible and maxilla by the unerupted teeth.

A.B.VanAs ET AL (2006) [1]

Reported, the mandible as the most common site of facial fractures in children. Nevertheless the most common fracture sites in descending order of frequency were the orbit the frontal bone

and the maxilla. Orbital injuries results from the transmission of forces directly from a blow to the bony orbital ring and from the hydraulic pressure exerted by displaced soft tissues. Fractures of frontal bone are often associated with other facial fractures and significant neurological injury. Maxilla and midface fractures results from high impact and high velocity forces such as motor vehicle accidents.

Roslan Abdual Rahman ET AL (2007) [41]

Reported maxillofacial trauma is not common in children's, the incidence is increasing. The principles of treatment follow as the adults a few special considerations have to be taken in to account in order to improve quality of life the child in both short and long term. A multidisciplinary approach in the management is highly recommended.

Nicole M. Eggensperger ET AL (2008) [31]

The spectrum of craniofacial injuries is related to the specific developmental stage of the craniofacial skeleton. When planning

treatment in children's fractures, all of the following should be taken in to account:

The age of the patients

The anatomic site

Complexity of the fractures

The time elapsed since injury

Concomitant injuries

Internal fixation implies an open approach with subsequent subperiostal dissection which interrupts the osteogenic potential of the periosteum and creates scarring, which may further restrict growth. Therefore, conservative treatment of the growing bone is Preferred whenever possible.

Petteri Vananen ET AL (2008) [36]

Reported the new free-form plate was introduced to provide at least as strong fixation as the tested conventional biodegradable plate. No clinically relevant difference was found in the initial fixation properties offer-form plates fixed with into-the-plate counter sunk screws and those fixed with screws without heads.

Scott D Imahara ET AL (2008) [46]

Reported, causes and patterns of facial. Fractures vary with age. Cranial and central facial injuries are more common among toddlers and infants, and mandible injuries are more common among adolescents. Although bony craniofacial trauma is relatively uncommon among the pediatric population, at remains substantial source of mortality, morbidity, and hospital recourse use

Patrick Cole ET AL (2009) [35]

Reported management of pediatric mandible fractures is substantially different from that of adult injury. This is due primarily to the presence of multiple tooth buds throughout the substance of the mandible as well as to the potential injury to the future growth. Although these issuses complicate the management of pediatric mandible fractures, these younger also have the potential for remodeling, as opposed to sclerotic, functional remodeling seen in adults. Mandible fractures are commonplace in today's craniofacial practice; however, managing the infrequent, operative pediatric mandible injury requires a thorough knowledge base and thoughtful

approach. Not only do these patients demonstrate variable anatomy due to different differing stages of dental eruption, but condylar disruption may translate into long-term growth disturbance. In addition, patient immaturity often complicates cooperation, and both fixation strategies and postoperative planning must take this into account.

Hanna Thoren ET AL (2009) [17]

Reported that the incidence of children diagnosed with facial fracture was not changed with time. A comparison of 2 -10 years of period revealed different fracture patterns and causative factors. The proportion of patient identified with midfacial fractures increased with time, probably to the increased use of adequate imaging. Because conventional radiographs are inexact for diagnosis of midfacial fracture, the threshold for using CT should be low whenever there is suspicion of such a fracture.

Teoman Eskitascioglu ET AL (2009) [55]

Stated maxillofacial fractures are encountered less commonly during childhood period due to anatomic, social, cultural, and environmental factors. Although the incidence of all maxillofacial fractures is 1% to 15% among pediatric and adolescent patients, this rate drops to less than 1% in children below 5 years age. Presence of teeth buds in pediatric mandible make the mandible to be fractured more easily. Regardless of the fracture mechanism and localization, pediatric mandibular fractures which are seen less frequently compared with those of adults, require a specific and different treatment. Although mostly less invasive methods are preferred. Open reduction should be considered when required.

Sunil Sharma ET AL (2009) [52]

Reported mandibular fractures in children most commonly occur in condylar region, followed by parasymphysis and angle. The fractures tend to be minimally displaced and in majority of cases can be treated conservatively. Significantly displaced mandibular fractures are reduced and immobilized using rigid internal fixation according to

principles used in adults. Fractures in condylar region usually are treated using non operative therapies as in most cases fracture heals and condyle is remodeled with successful anatomic and functional results.

Walid A. Abdullah ET AL (2009) [57]

Reported using one microplate with 1.5 monocortical screws and dental tension band appeared adequate for the fixation of pediatric mandibular fractures. The procedure had the benefits of decreasing the amount of titanium used, decreasing the risk of injury of the roots and teeth buds, and decreasing the cost and time of surgery.

GEORGE M. KUSHNER ET AL (2009) [15]

Reported management of pediatric maxillofacial trauma and especially mandibular trauma is both challenging and rewarding. The majority of pediatric mandibular fractures can be managed with closed techniques using short periods of MMF or training elastics alone. However, there will always be reason to platform open reductions with internal

fixation. This is generally reserved for difficult fractures which are grossly displaced and multiple in nature.

SERHAT ATILGAN ET AL (2010) [47]

Reported the most common causes of injury were falls (65%) in young patients and traffic accidents (38%) in adults. The most common fractures sited were the symphysis (35%) and condyle (36%) in young patients, and the symphysis in adults (36%). Mandibular fractures were generally treated by arch bar and maxillomandibular fixation in both young (67%) and adult (39%) patients, and 43% of the adults patients were treated by open reduction and internal fixation.

J.L.MUNANTE CARDENAS ET AL (2010) [21]

Reported the incidents of trauma and mandibular fractures in pediatric and adolescent patients wash high in the area of study, the bicycle accidents and fall being the main etiological factor. The mandibular condyle was the most affected mandibular region. The group of adolescents was the age group most affected. The conservative and surgical treatments were used almost in the same proportion. Despite that complication rate were

low, patients in the growing phases should be monitored periodically to detect early facial asymmetries or malocclusions development.

BABY JOHN ET AL (2010) [4]

Reported in their study ,the anatomical complexity of the developing mandible and teeth concerns regarding biocompatibility of implanted hardware often mandate the use of surgical techniques that differ markedly from those used in adults .In case of mandibular fractures of a young child, distruption of periosteal envelope may have unpredictable effects on growth. Thus if intervention is required, closed reduction is favored. Due to the technical difficulties of IMF, acrylic splints with circumferential wiring are recommended.

IOANNIS IATROU ET AL (2010) [20]

Reported the usefulness of open reduction and plate fixation in children. There was no need for wire suspension and only occasional need for IMF. Titanium plates were removed after fracture healing.

R. BALI ET AL (2011) [38]

Reported the use of bioresorbable fixation systems has been gaining fast momentum in contemporary maxillofacial traumatology. While indications continue to expand with improvements in strength and profiles of these implants, undesirable events, including localised sterile abscesses and osteolytic changes, have been reported during degradation of these products. He reported a case of a fracture of pediatric mandibular angle managed with bioresorbable fixation that showed significant bone resorption adjacent to the fixation site 18 months post-operatively.

Aim

AIM

The aim of this study was to prospectively analyze the effect of open reduction and internal fixation for treating various pediatric mandibular fractures and evaluating the advantages and disadvantages of ORIF along with the assessment of any complications.

Objectives

OBJECTIVES

The pattern of mandible fractures seen in children and adults varies with evolving skeletal anatomy and socio environmental factors .The general principle of treating fractures are same in children and adults:

Anatomic reduction is combined with adequate stabilization to maintain the bony fragment in position until bony union is achieved. But recognition of some of the differences between adults and children's fracture healing is seen. It is important with regards to long term facial esthetics and functional facial rehabilitation.

The objective of this study is to evaluate the use of open reduction and internal fixation in displaced pediatric mandibular fractures.

Material & Methods

MATERIAL AND METHODS

The present study "**Open Reduction and Rigid fixation in pediatric mandibular fractures**" was undertaken in the Department of oral & Maxillofacial Surgery, Rajas Dental College Kavalkinaru

The criteria for selection of cases being

1 Patients Below 14 years of age

2 Gross Displacement of the fracture segments

3 Patients without any medical problems

The study included total number of 11 patients reported during the period between 2009-2012 out of which 7 patients were boys & 4 were girls. The youngest of patients age being 6 years & oldest was 12 years. The causes included RTA, fall from cycle & sports injuries. All 11 patients were the subjects of this follow up study. Each patient was given the following evaluation:

1. Extra oral & Intraoral clinical examination

2. Periapical radiographs of the affected site

3. Lateral oblique view where required

4. Pre operative and post operative OPG

5 Routine blood investigation

6. Chest x-ray

7. ECG

8. All the diagnostic procedures were performed without medication or sedation.

All 11 patients were advised treatment by open reduction and internal fixation. Average time for surgery was 45-70 minutes.

All the patients selected for ORIF were operated under GA with naso –tracheal intubation. An intra oral approach was used in 10 of the 11 fracture patients treated. One angle fracture was treated through an extra oral approach. In intra oral approach a vestibular incision was placed to expose the fracture site. Care was taken to make the exposure and stripping

of periosteum to the minimum, since it reportedly can interfere with future growth of mandible. Reduction was achieved by gentle manipulation and held in occlusion with temporary IMF using minimal eyelets and tie wires.

The appropriate implant was selected which was adapted onto the buccal cortex at the lowest position and fixed using suitable screws .The plates used were 4 hole continuous monocortical mini plates with screws of 1.5 mm diameter & length 5mm .Both titanium & stainless steel plates were used .selection of which was based on the financial status of the patient .Even though we followed Champy's principles, modification were done in sites where there were unerrupted tooth buds.

Occlusal reassessment was done immediately after plating. Incision lines were closed using 3-0 vicryl sutures. Patients were given antibiotics & analgesics for a period of 5-7 days . Post-operatively patients were advised to have soft diet for a period of 1 month.post-operative checkups were done at an interval of 1 week,1 month,2 months and 6 months. Union of fracture site was tested by palpating for mobility at the fracture site. The patient was also asked to open the mouth against force applied at the point of the chin by the operator's hand. If this manoeuvre produced pain at the fracture site, union was considered to be inadequate. During this period only 1 patient

reported with mild infection at the incision line,which was successfully managed by oral antibiotics and local measures .In all the other patients postoperative evaluation period was uneventful. Once bone healing was complete implant removal was done after 6 months of surgery.

Case Proforma

CASE PROFORMA

DATE

NAME

AGE: SEX:

Address:

Person accompanying:

CHIEF COMPLAINT

HISTORY OF PRESENTING ILLNESS

PAST DENTAL HISTORY

PAST MEDICAL HISTORY

DRUG HISTORY

FAMILY HISTORY

GENERAL EXAMINATION

JAUNDICE: CYANOSIS

ANAEMIA: CLUBBING

LYMPHADENOPATHY:

VITAL SIGN

PULSE:

TEMPERATURE

RESPIRATORY RATE

BLOOD PRESSURE

SYSTEMIC EXAMINATION:

CNS

CVS

GIT

RS

LOCAL EXAMINATION

SOFT TISSUE EXAMINATION:

1 Haemorrhage

2 Laceration

3 Tissue Loss

4 Abrasion

5Oedema

6 Ecchymosis

7 Contour defects

BUCCAL MUCOSA

PALATE

TONGUE

FLOOR OF THE MOUTH

LIPS

HARD TISSUE EXAMINATION

Teeth present

Missing teeth

Fractured teeth

Occlusion

a) Prior to surgery Right Left

b) Post surgery Right Left

INSPECTION

PALPATION

PERCUSSION

PROVISIONAL DIAGNOSIS

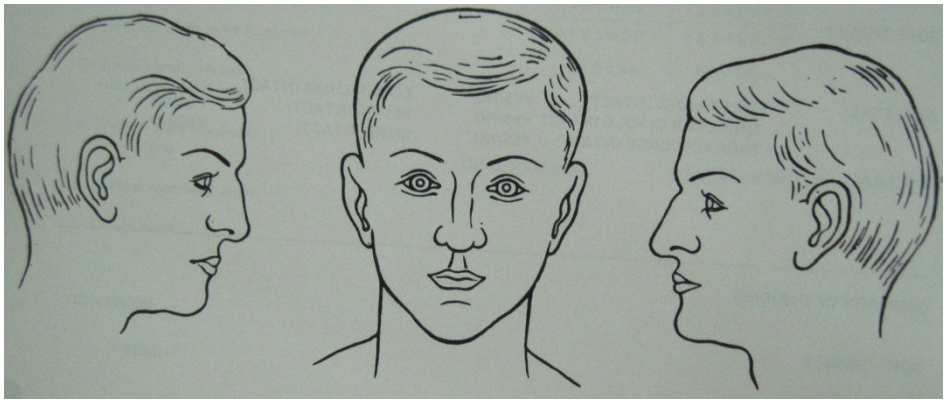
INVESTIGATIONS

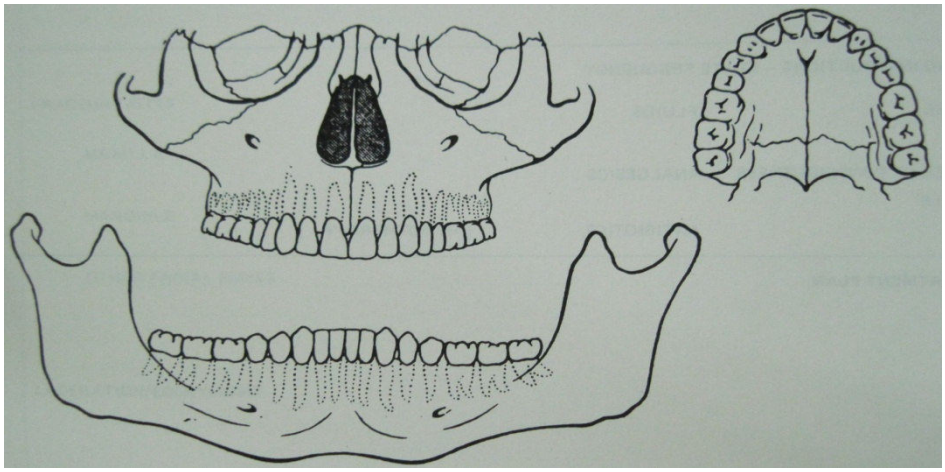
FINAL DIAGNOSIS

TREATMENT PLAN

Follow up

GRAPHIC SUMMARY





DATE OF INJURY

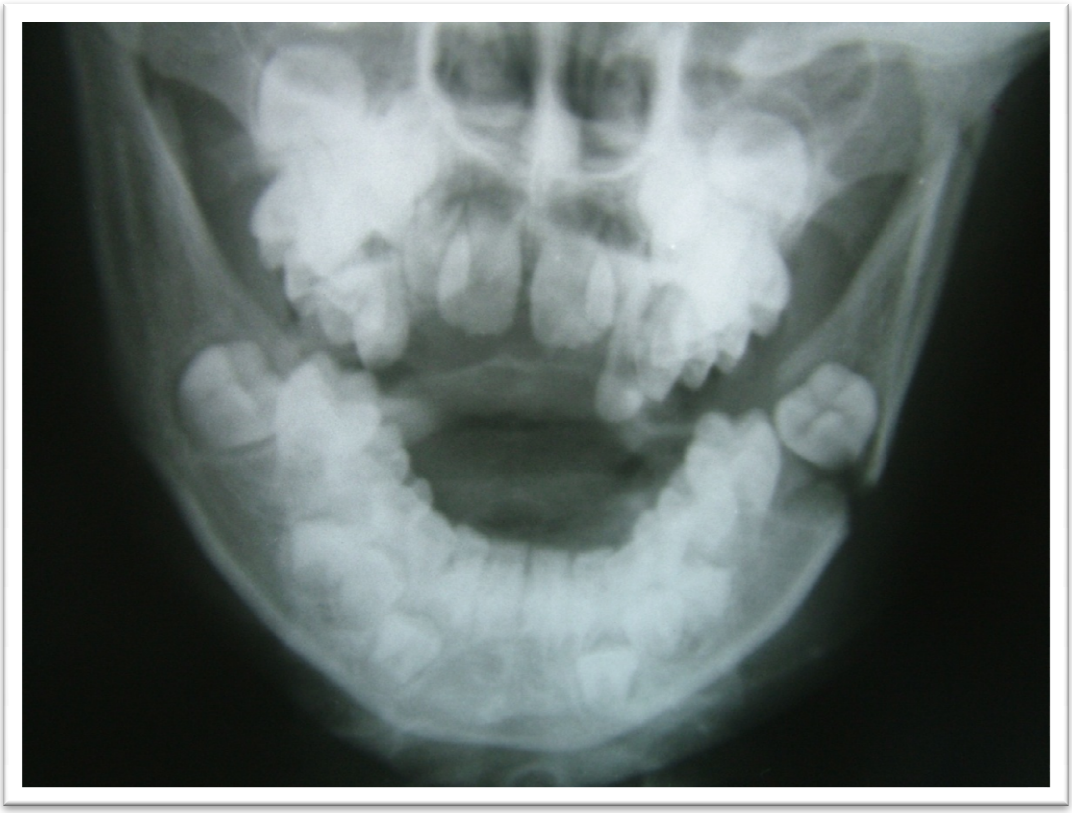
DATE OF SURGERY

COMPLICATIONS

PARAMETERS	3 days	1 week	2 weeks	1 month	6 months
PAIN					
WOUND HEALING					
INFECTION					
OCCLUSION					
SEGMENT MOBILITY					
SCAR					
SWELLING					
POST OP IMF					

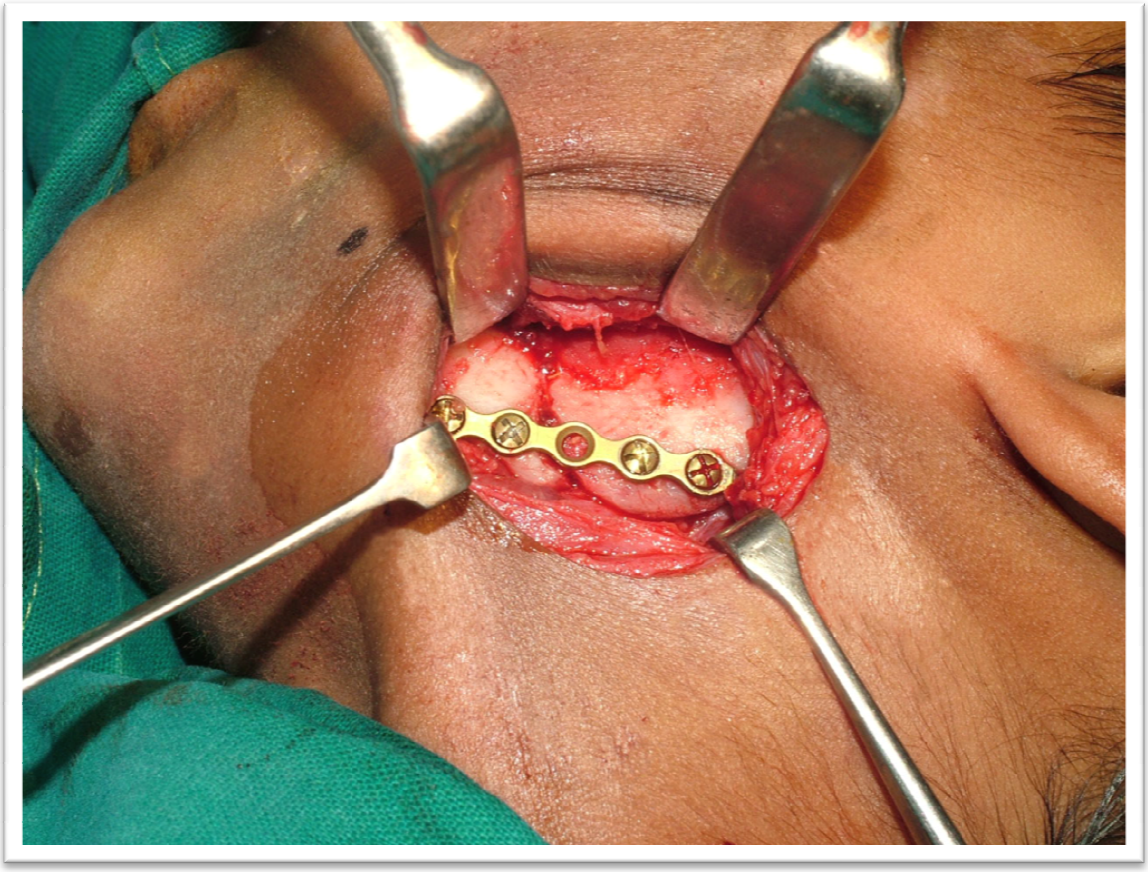
Clinical Pictures

Case 1



Preoperative OPG

Case 1



Intra Operative

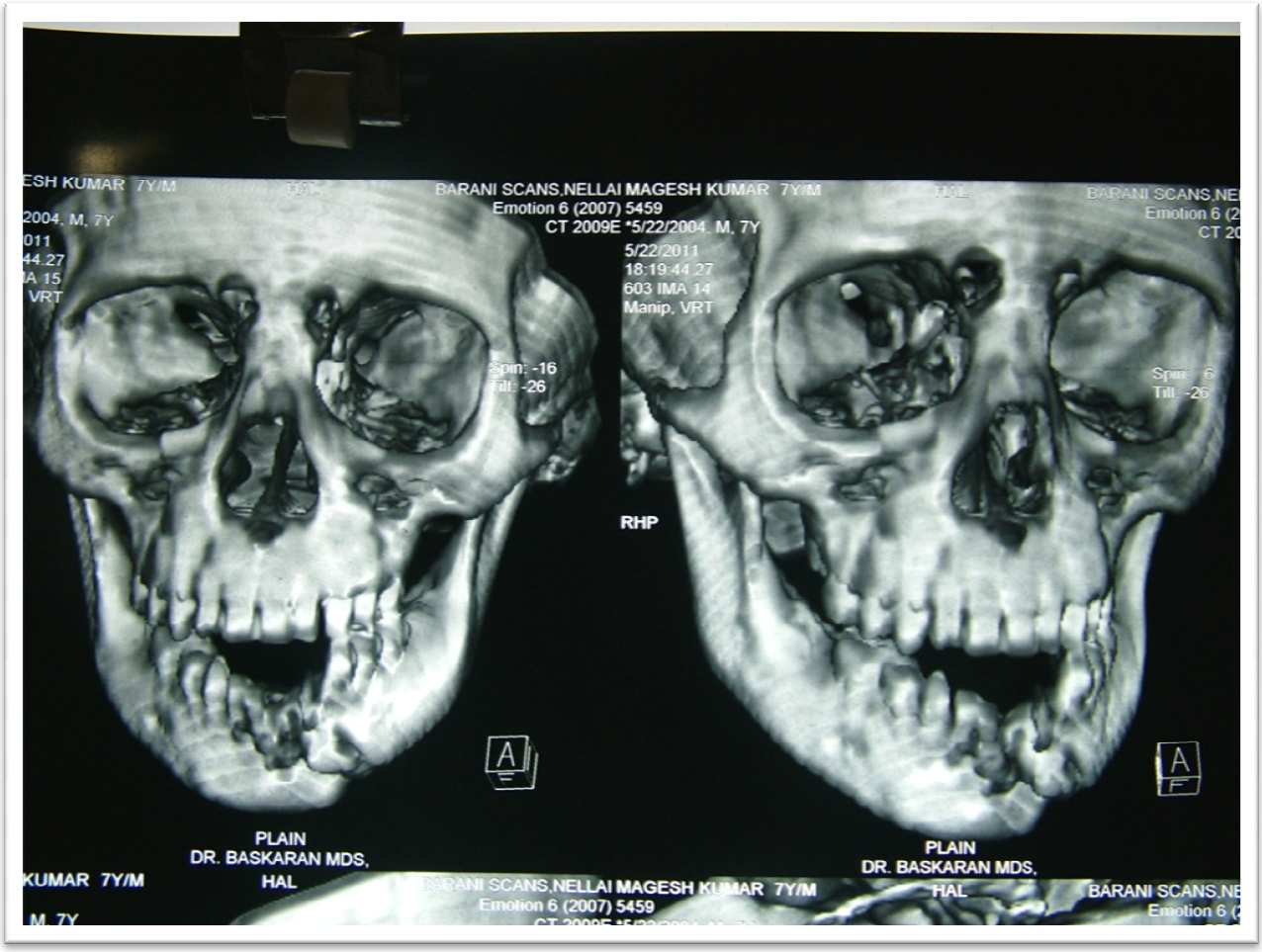
Case 1

Closure

Case 1

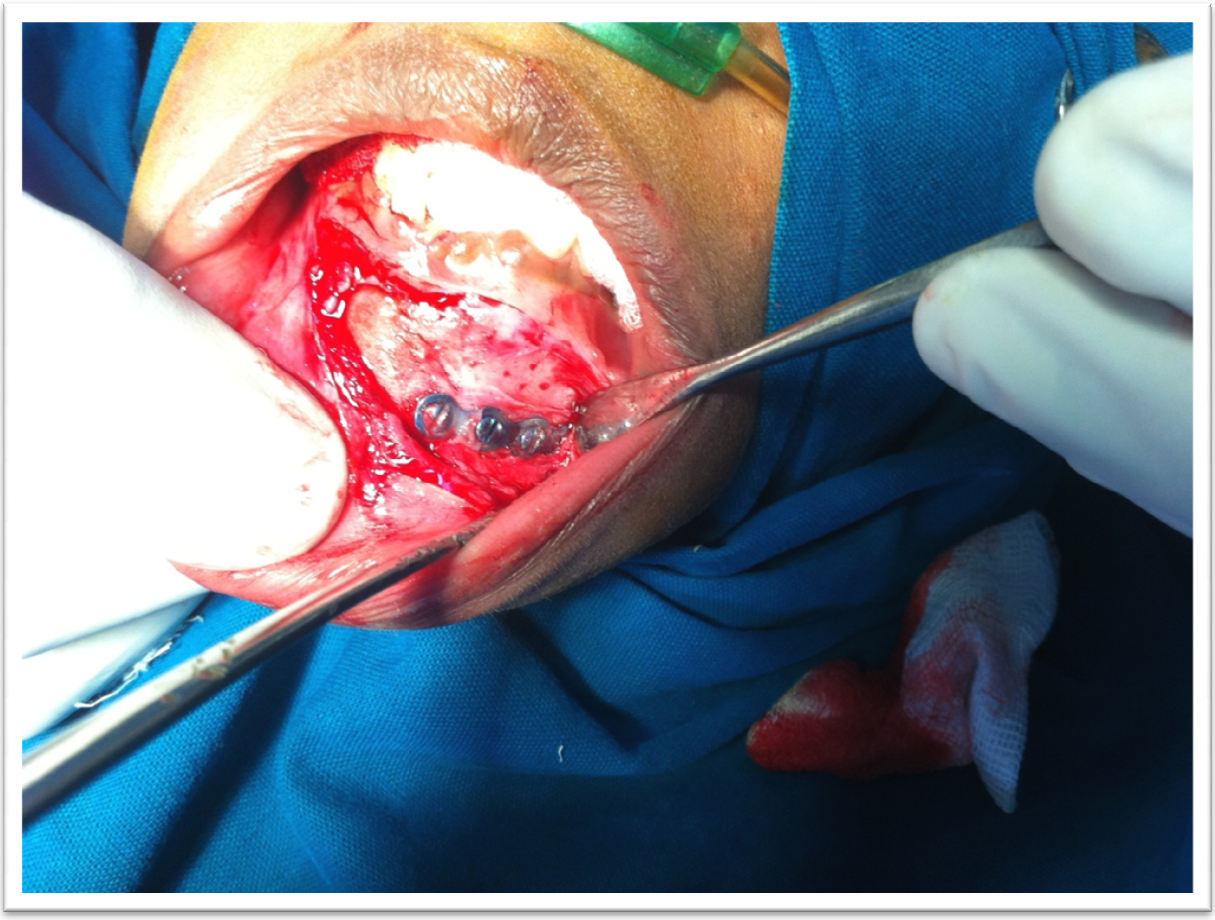
Post Operative OPG

Case 2



Preoperative

Case 2



Intra Operative

Case 2

Preoperative OPG

Case 2

1 Week Postoperative

Case 2

1 Month Postoperative

RESULTS

RESULTS

Post operative pain was calculated based on the following grading:-

Not Present

Mild

Moderate

Severe

The results were tabulated (graph D & E)

One case of infection (Table iv) was reported at the site of fracture along the suture line .Of the 11 patients,1 fracture of the angle of the mandible was approached through an extra oral incision to reach the lower border of the mandible (table x), and for perpendicular angulations of the screws. Hence extra oral scar was seen in 1 of the patients. There was no scar hypertrophy

An orthodontist evaluated the occlusion on the first and second post operative visit and at 6 months and found it to be ideal in all patients

There was no mobility of the segments post operatively. (table iv)

Return to function and patient comfort was the major concern. Most of the patients showed impressively rapid recovery and return to their normal activity within a week

Tables

Sl No	*Name of patient*	*Age*	*Sex*	*Reported*	*Operated*	*Diagnosis*
1	Lithiya	11	F	15/08/09	16/08/09	Rt Symphysis Fracture
2	Neethu.S	10	F	04/09/09	06/09/09	Body of Mand Rt Fracture
3	Stalin	11	M	12/10/09	13/10/09	Rt Parasymphysis Fracture
4	Dineesh.M	9	M	20/01/10	21/01/10	Lt Body of Mandible Fracture
5	Vimal	8	M	07/03/10	08/03/10	Lt Parasymphysis Fracture
6	Mast Praveen	12	M	23/04/10	24/04/10	Lt symphysis Fracture
7	Baby Monisha	8	F	23/05/10	24/05/10	Rt Symphysis Fracture
8	Mahesh Kumar	7	M	04/06/10	05/06/10	Rt Angle of Mandible Fracture
9	Rahul.S	10	M	11/12/10	12/12/10	Rt Parasymphysis Fracture
10	Akhil	6	M	25/02/11	26/02/11	Symphysis Fracture
11	Sulbiah Rahmath	7	F	27/03/11	28/03/11	Lt Parasymphysis Fracture

Sl No	Name of patient	Pain				
		3 Days	1 Week	2 Week	1 Month	6Month
1	Lithiya	Moderate	Mild	Mild	Not Present	Not present
2	Neethu.S	Moderate	Mild	Mild	Not Present	Not Present
3	Stalin	Moderate	Mild	Mild	Mild	Not Present
4	Dineesh.M	Severe	Severe	Severe	Moderate	Not Present
5	Vimal	Severe	Moderate	Moderate	Mild	Not Present
6	Mast Praveen	Moderate	Moderate	Mild	Not Present	Not Present
7	Baby Monisha	Moderate	Moderate	Mild	Mild	Not Present
8	Mahesh Kumar	Severe	Moderate	Mild	Not Present	Not Present
9	Rahul.S	Moderate	Mild	Mild	Not Present	Not Present
10	Akhil	Moderate	Mild	Mild	Not Present	Not Present
11	Sulbiah Rahmath	Moderate	Mild	Mild	Not Present	Not Present

Sl No	*Name of patient*	*Wound Healing*		
		1 Week	*2 Week*	*1 Months*
1	Lithiya	Healing	Healed	Healed
2	Neethu.S	Healing	Healed	Healed
3	Stalin	Healing	Healed	Healed
4	Dineesh.M	Healing	Healed	Healed
5	Vimal	Healing	Healed	Healed
6	Mast Praveen	Healing	Healed	Healed
7	Baby Monisha	Healing	Healed	Healed
8	Mahesh Kumar	Healing	Healed	Healed
9	Rahul.S	Healing	Healed	Healed
10	Akhil	Healing	Healed	Healed
11	Sulbiah Rahmath	Healing	Healed	Healed

Sl No	***Name of patient***	***Infection***				
		3 Days	***1 Week***	***2 Week***	***1 Months***	***6 Months***
1	Lithiya	Nil	Nil	Nil	Nil	Nil
2	Neethu.S	Nil	Nil	Nil	Nil	Nil
3	Stalin	Nil	Nil	Nil	Nil	Nil
4	Dineesh.M	Mild Infection	Mild Infection	Mild Infection	Nil	Nil
5	Vimal	Nil	Nil	Nil	Nil	Nil
6	Mast Praveen	Nil	Nil	Nil	Nil	Nil
7	Baby Monisha	Nil	Nil	Nil	Nil	Nil
8	Mahesh Kumar	Nil	Nil	Nil	Nil	Nil
9	Rahul.S	Nil	Nil	Nil	Nil	Nil
10	Akhil	Nil	Nil	Nil	Nil	Nil
11	Sulbiah Rahmath	Nil	Nil	Nil	Nil	Nil

Sl No	*Name of patient*	*Occlusion*				
		3 Days	*1 Week*	*2 Week*	*1 Months*	*6 Months*
1	Lithiya	Present	Present	Present	Present	Present
2	Neethu.S	Present	Present	Present	Present	Present
3	Stalin	Present	Present	Present	Present	Present
4	Dineesh.M	Present	Present	Present	Present	Present
5	Vimal	Present	Present	Present	Present	Present
6	Mast Praveen	Present	Present	Present	Present	Present
7	Baby Monisha	Present	Present	Present	Present	Present
8	Mahesh Kumar	Present	Present	Present	Present	Present
9	Rahul.S	Present	Present	Present	Present	Present
10	Akhil	Present	Present	Present	Present	Present
11	Sulbiah Rahmath	Present	Present	Present	Present	Present

Sl No	*Name of patient*	*Segment Mobility*				
		3 Days	*1 Week*	*2 Week*	*1 Months*	*6 Months*
1	Lithiya	Not Present	Not Present	Not Present	Not Present	Not Present
2	Neethu.S	Not Present	Not Present	Not Present	Not Present	Not Present
3	Stalin	Not Present	Not Present	Not Present	Not Present	Not Present
4	Dineesh.M	Not Present	Not Present	Not Present	Not Present	Not Present
5	Vimal	Not Present	Not Present	Not Present	Not Present	Not Present
6	Mast Praveen	Not Present	Not Present	Not Present	Not Present	Not Present
7	Baby Monisha	Not Present	Not Present	Not Present	Not Present	Not Present
8	Mahesh Kumar	Not Present	Not Present	Not Present	Not Present	Not Present
9	Rahul.S	Not Present	Not Present	Not Present	Not Present	Not Present
10	Akhil	Not Present	Not Present	Not Present	Not Present	Not Present
11	Sulbiah Rahmath	Not Present	Not Present	Not Present	Not Present	Not Present

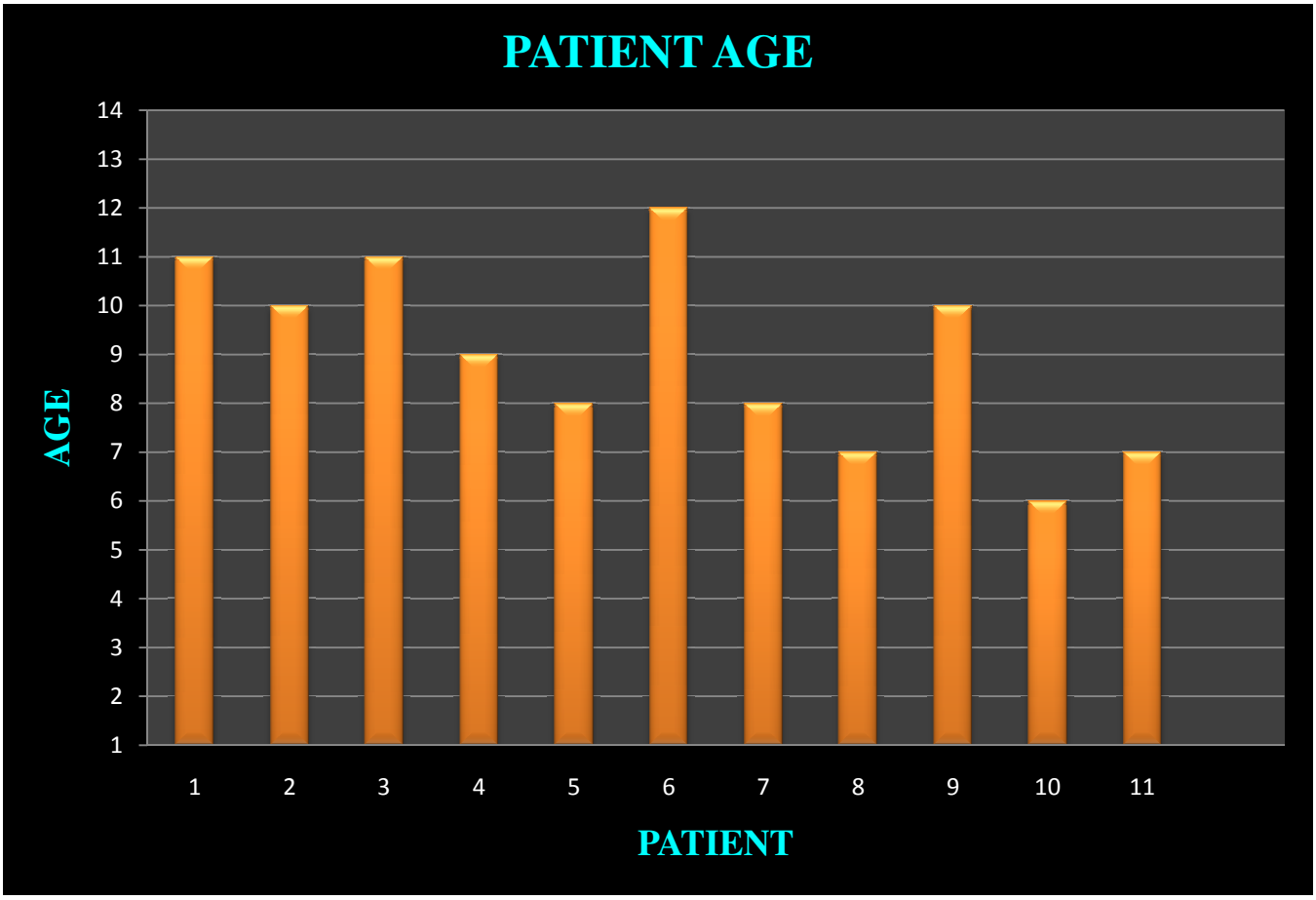
Sl No	***Name of patient***	***Scar***		
		2 Week	***1 Months***	***6 Months***
1	Lithiya	Not Present	Not Present	Not Present
2	Neethu.S	Not Present	Not Present	Not Present
3	Stalin	Not Present	Not Present	Not Present
4	Dineesh.M	Not Present	Not Present	Not Present
5	Vimal	Not Present	Not Present	Not Present
6	Mast Praveen	Not Present	Not Present	Not Present
7	Baby Monisha	Present	Not Present	Present
8	Mahesh Kumar	Present	Present	Present
9	Rahul.S	Not Present	Not Present	Not Present
10	Akhil	Not Present	Not Present	Not Present
11	Sulbiah Rahmath	Not Present	Not Present	Not Present

Sl No	***Name of patient***	***Intra operative***	***IMF Postoperative***			
			3 Days	***1 Week***	***2 Week***	***1 Months***
1	Lithiya	Present	Nil	Nil	Nil	Nil
2	Neethu.S	Present	Nil	Nil	Nil	Nil
3	Stalin	Present	Nil	Nil	Nil	Nil
4	Dineesh.M	Present	Nil	Nil	Nil	Nil
5	Vimal	Present	Nil	Nil	Nil	Nil
6	Mast Praveen	Present	Nil	Nil	Nil	Nil
7	Baby Monisha	Present	Nil	Nil	Nil	Nil
8	Mahesh Kumar	Present	Nil	Nil	Nil	Nil
9	Rahul.S	Present	Nil	Nil	Nil	Nil
10	Akhil	Present	Nil	Nil	Nil	Nil
11	Sulbiah Rahmath	Present	Nil	Nil	Nil	Nil

Sl No	Name of patient	Swelling			
		3 Days	1 Week	2 Week	1 Months
1	Lithiya	Moderate	Mild	Not Present	Not Present
2	Neethu.S	Moderate	Mild	Not Present	Not Present
3	Stalin	Moderate	Mild	Not Present	Not Present
4	Dineesh.M	Severe	Moderate	Not Present	Not Present
5	Vimal	Moderate	Mild	Not Present	Not Present
6	Mast Praveen	Moderate	Mild	Not Present	Not Present
7	Baby Monisha	Moderate	Mild	Not Present	Not Present
8	Mahesh Kumar	Moderate	Mild	Not Present	Not Present
9	Rahul.S	Moderate	Mild	Not Present	Not Present
10	Akhil	Moderate	Mild	Not Present	Not Present
11	Sulbiah Rahmath	Moderate	Mild	Not Present	Not Present

S.No	Name	Approaches
1	Lithiya	Intra Oral
2	Neethu.S	Intra Oral
3	Stalin	Intra Oral
4	Dineesh.M	Intra Oral
5	Vimal	Intra Oral
6	Mast Praveen	Intra Oral
7	Baby Monisha	Intra Oral
8	Mahesh Kumar	Extra Oral
9	Rahul.S	Intra Oral
10	Akhil	Intra Oral
11	Sulbiah Rahmath	Intra Oral

Graphs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13
12
11
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8
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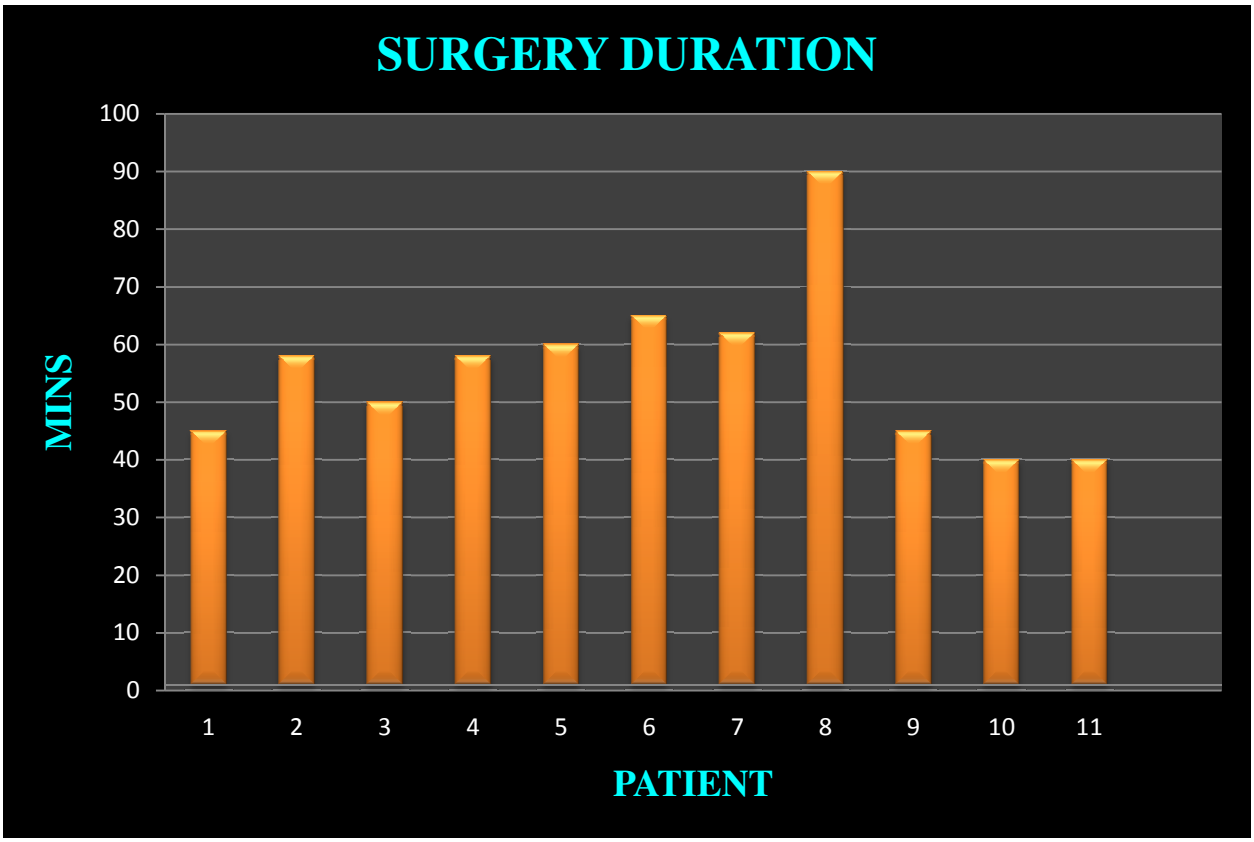
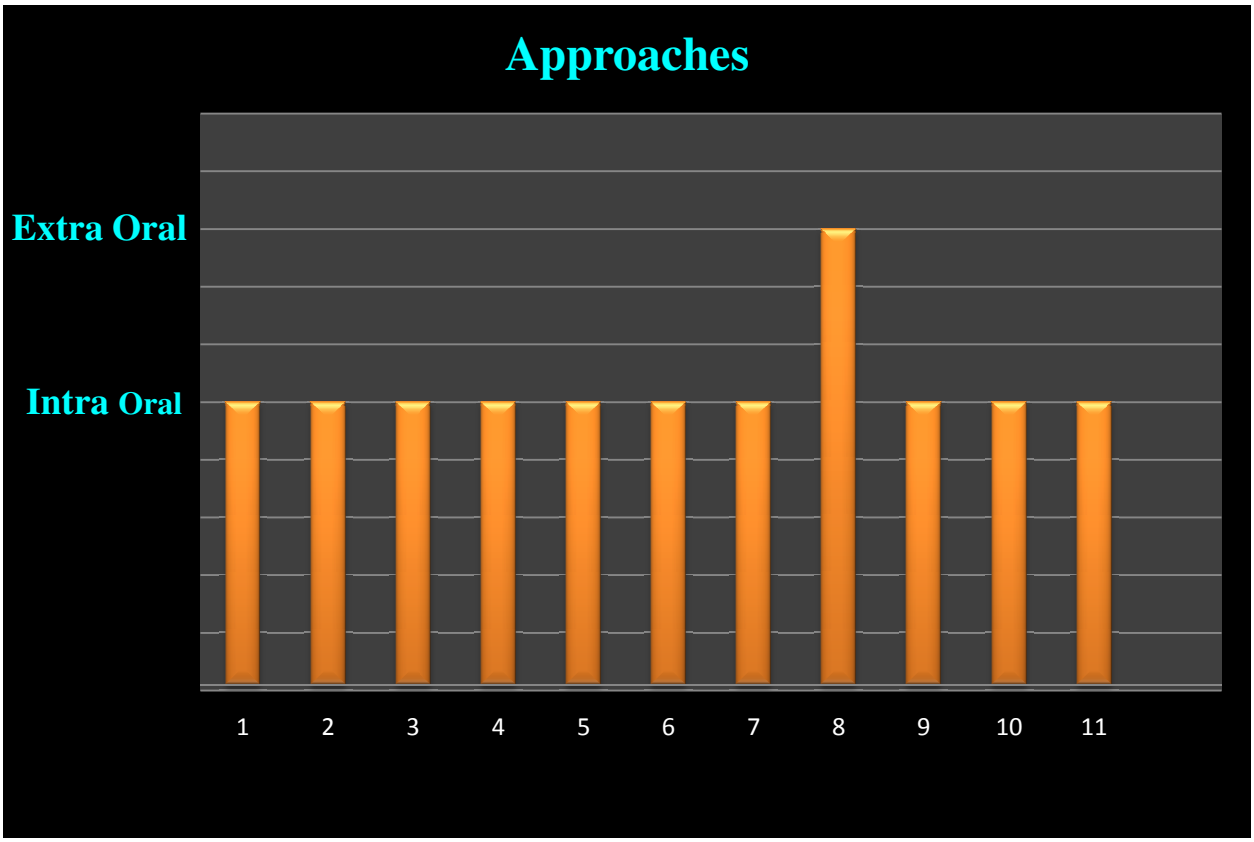
PATIENT

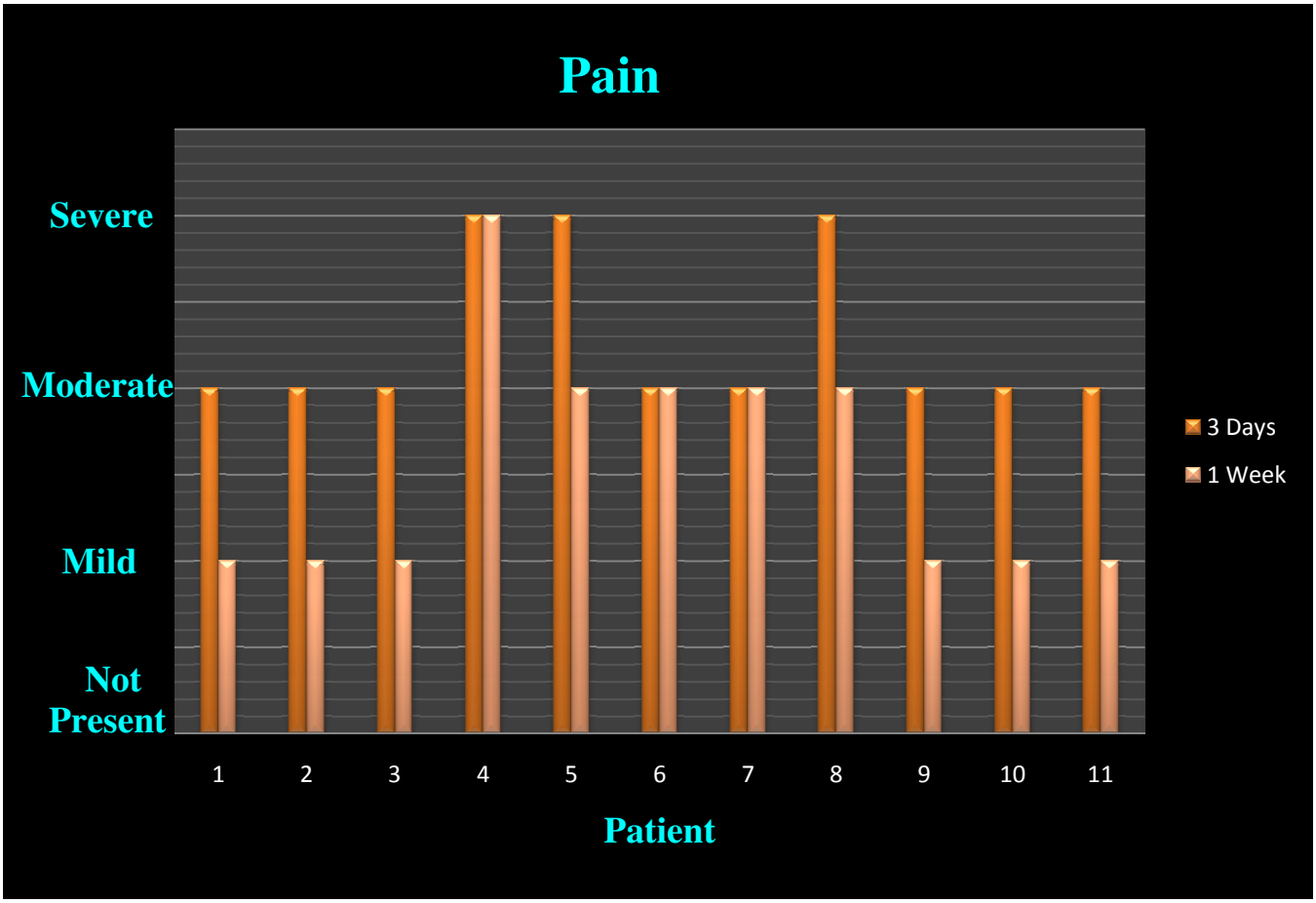
Patient Age



SURGERY DURATION



Approaches


Pain
Severe
Moderate
Mild
Not Present
1
2
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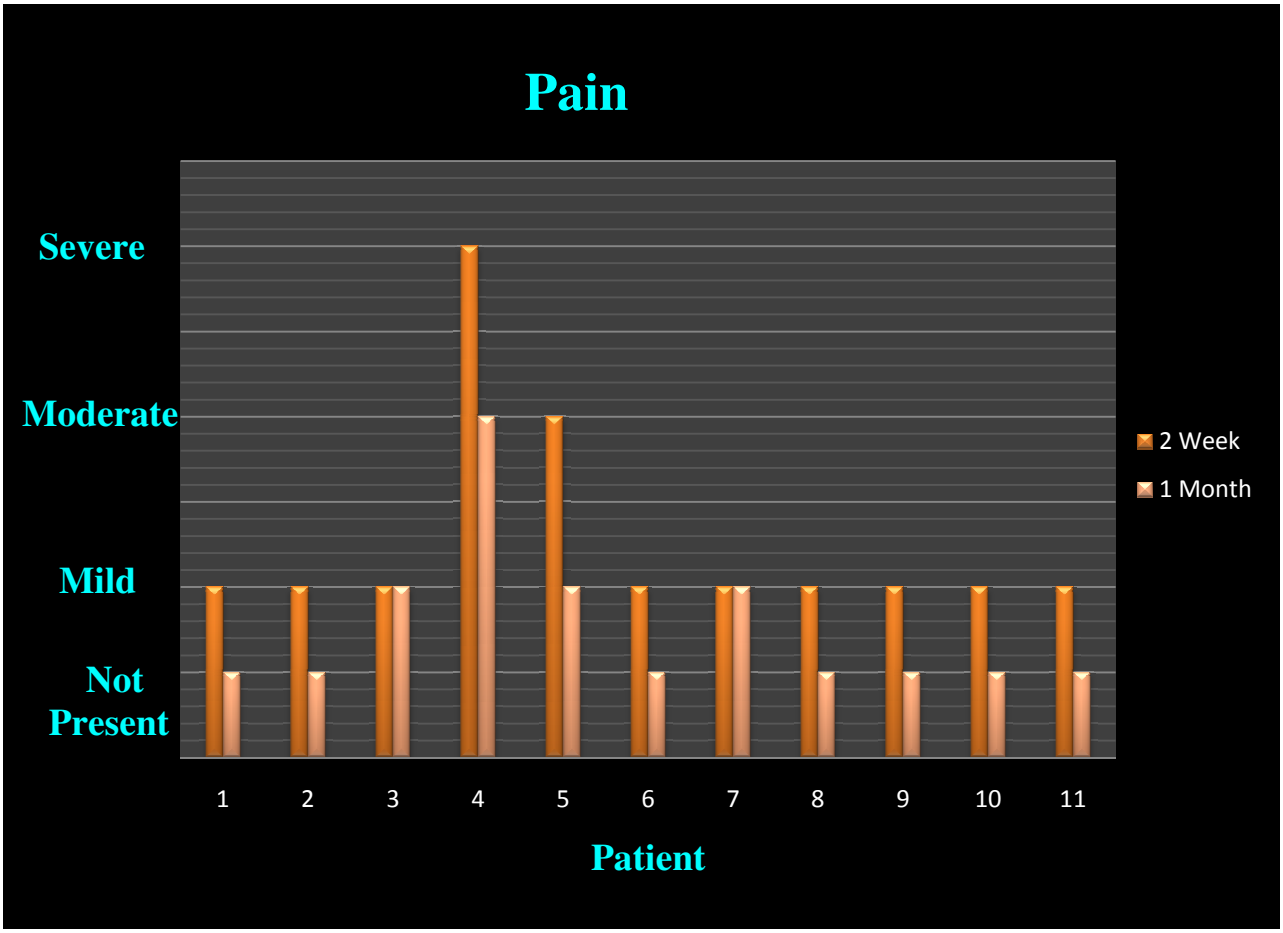
11
Patient
3 Days
1 Week

Pain


Pain
Severe
Moderate
Mild
Not Present
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5
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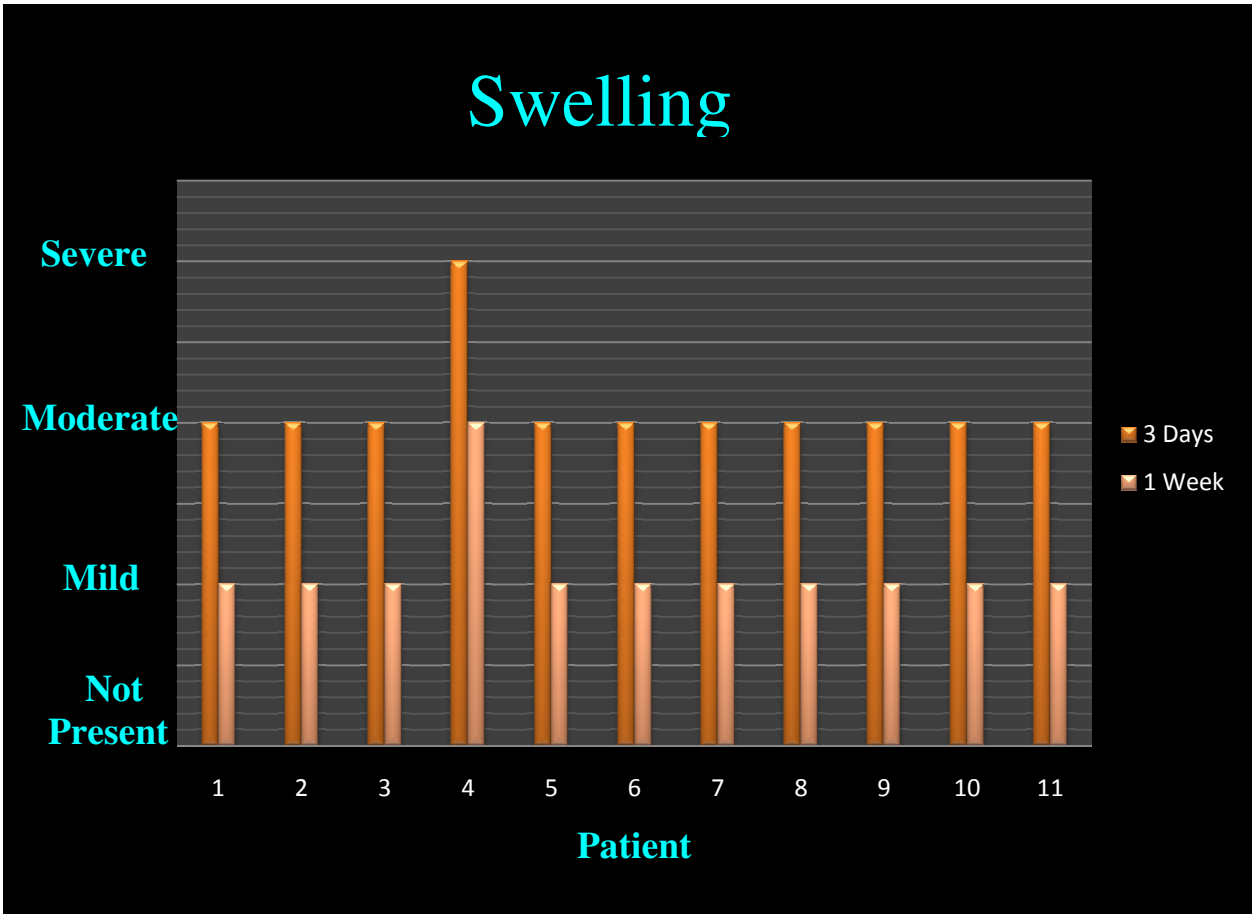
8
9
10
11
Patient
2 Week
1 Month

Pain


Swelling
Severe
Moderate
Mild
Not Present
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6
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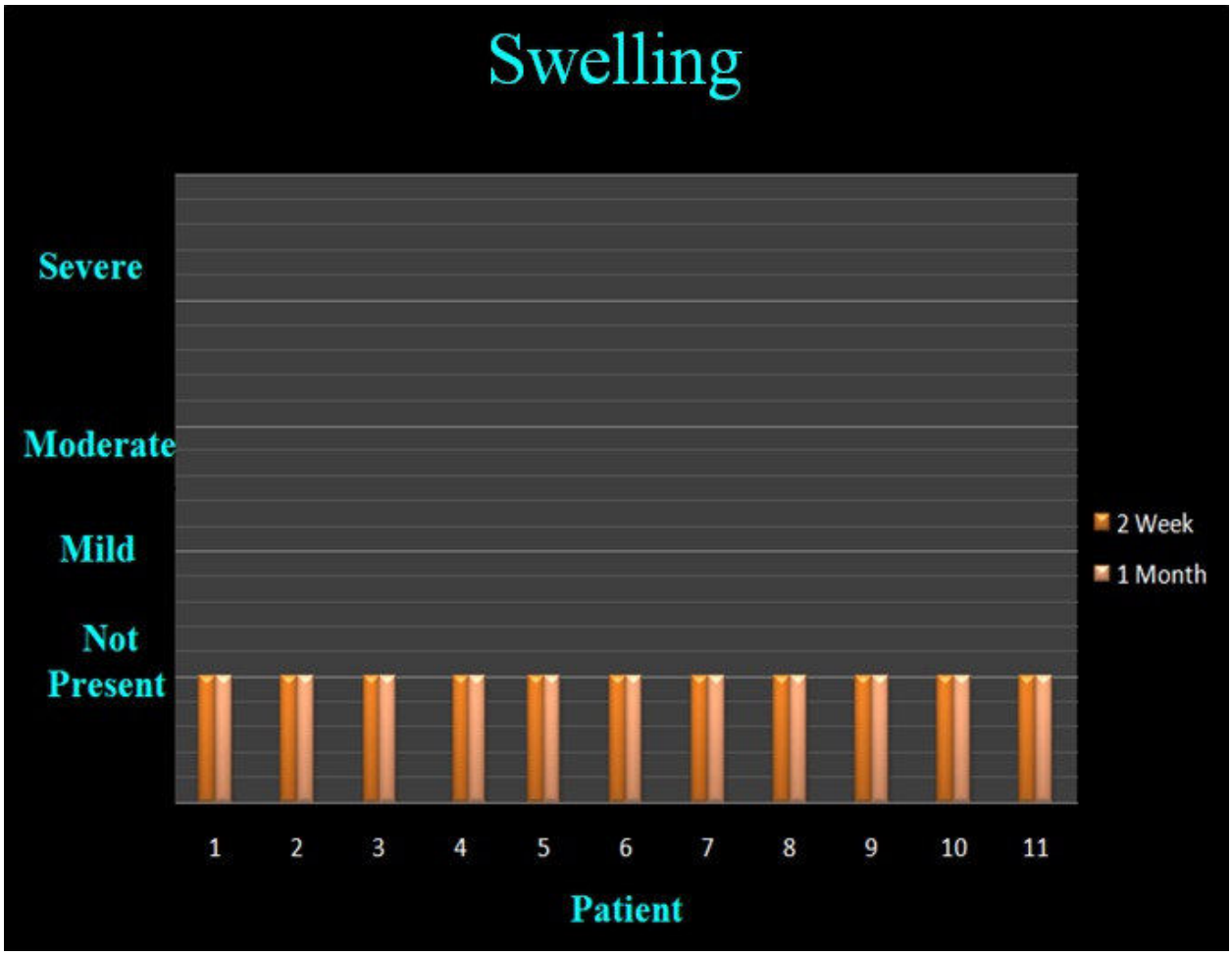
10
11
Patient
3 Days
1 Week

Swelling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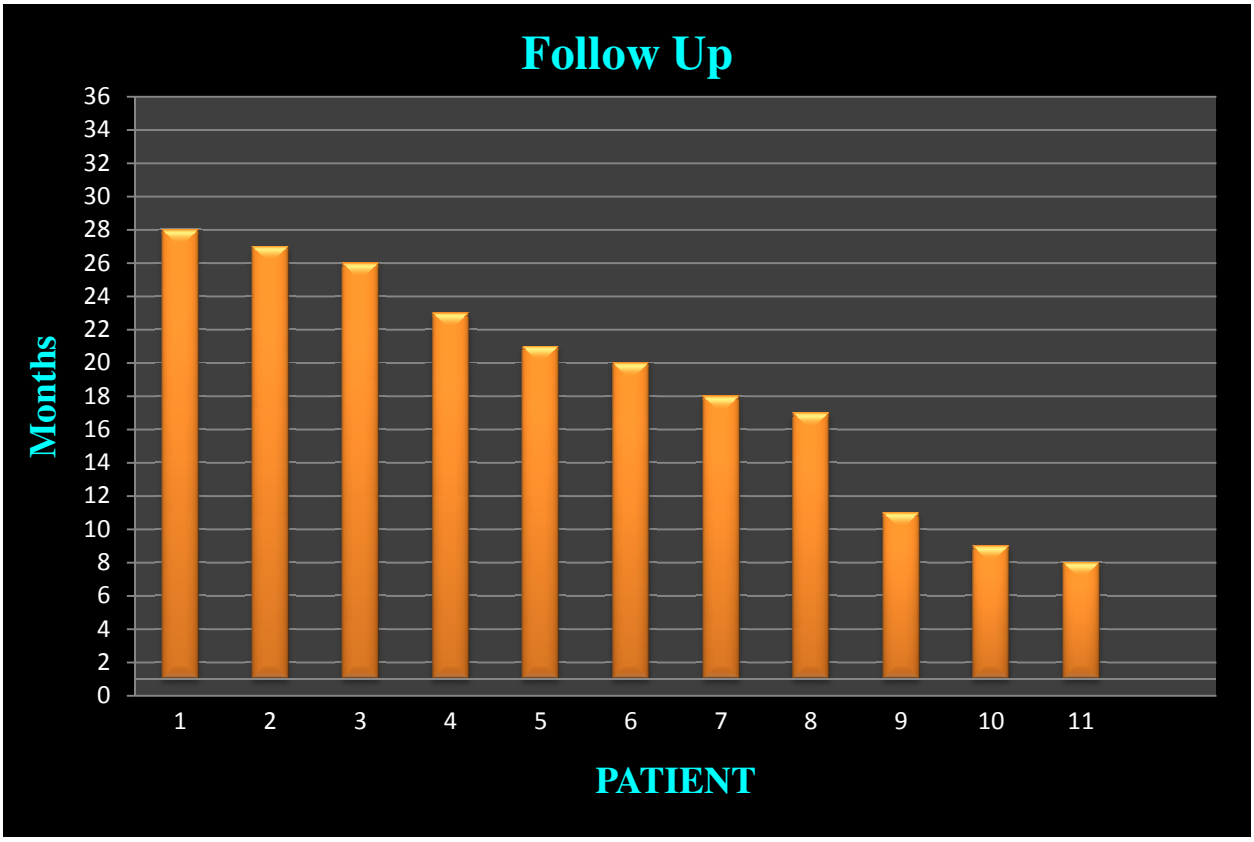
Patient

Swelling


Follow Up
Months
36
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PATIENT

Follow UP

Discussion

DISCUSSION

Although much has been written about maxillofacial fractures in pediatric age population controversy continues regarding the management of these injuries. These controversies have arisen in part due to the unique characteristics of these fractures, in part due tojk the differences in maxillofacial structures in children and in part from the recognition that the pediatric facial skeleton is not a static system but a dynamic growing entity. Also there are very few studies documenting long term follow up.

Mandibular fractures in pediatric population are relatively uncommon. These patients present with their own unique treatment requirements. Closed reduction with MMF in young children though in theory seems a better option can pose several concerns including patient co-operation, compliance and adequate nutrition .Treatment of fractures using ORIF on the other hand circumvents the above concerns like the need for MMF and allows immediate jaw mobilization , early recovery and return to early function.

In the past open reduction was generally avoided because damage to the tooth buds was a major concern. However with the current availability

of miniplates and microplates, it is possible to perform open reduction & internal fixation without damaging the tooth buds.

As in the adult population inadequate reduction & fixation in pediatric, displaced facial fractures will result in malunion and contour deformities and secondary surgery may be needed to correct residual deformities. Although some remodeling potential remains in the pediatric cranio-facial skeleton, it is unpredictable and provides a poor rationale for inadequate anatomic reduction and fixation. Instead the bony fragments should be reduced in the pre injury pattern with the teeth in occlusion, until union has occurred. The increased osteogenic potential of the pediatric facial skeleton should make early definitive treatment the rule.

When Open reduction is indicated we often prefer the use of more stable methods of fixation that is micro or mini plates and screws.

Advantages of plate & screw fixation that are especially beneficial in the pediatric age group are:

1. No need for Maxillo Mandibular Fixation.

2. Decreased necessity for tracheostomy for airway management in polytrauma cases.
3. Early mobilization of patients with associated condylar fractures.
4. Minimal chance of damaging tooth buds compared to transosseous wiring.
5. Early return to normal oral feeding especially in an age group where metabolic and nutritional demands are high.
6. Early mobilization of patients leading to less risk of ankylosis in cases of condylar fracture

In all our patients where open reduction & Internal fixation had been done postoperative recovery was uneventful except in one patient who had mild infection of the incision line which was effectively managed with oral antibiotics and local measures.

Although our follow-up period was short with regards to determination of the late effects of trauma or the treatment on facial growth our preliminary impression was favorable. Once healing has occurred, it has been our practice to remove the implant hardware. The indication to

remove bone plates applied to a fractured pediatric mandible after bone healing and whether the retention may cause growth disturbances is still uncertain.

The development of resorbable plate & screw system may reduce our concern about using is implants in the growing facial skeleton. But there are studies showing the bone resorption after bioresorbable fixation of a fractured pediatric mandible, so long term prospective follow up and monitoring the effects on facial growth in patients who have undergone open reduction and internal fixation are still required.

Summary & Conclusion

SUMMARY & CONCLUSION

Management of mandibular fractures in children differs somewhat from that in adults because of anatomic variation, rapidity of healing, degree of patient cooperation and the potential for interference with mandibular growth. Therefore these patients require a different surgical approach. According to our study results we currently believe that certain principles in the management of these injuries can be outlined, recognizing that they may require modification as additional experience accumulates. These management principles are as follows:

1. Be as conservative as possible.
2. If indicated do open reduction & stable fixation as inadequate reduction and fixation will lead to malunion and contour deformities
3. Minimal exposure & stripping of periosteum, as excessive periosteal stripping can cause scarring & growth retardation.
4. Employing methods of fixation that adequately stabilize the facial skeleton without rigidly immobilizing long segments.

5. Monocortical miniplates or micro plates are preferred to bicortical screws and transosseous wires.
6. Compression plates should not be used as a rule.
7. Be aware of the pediatric dentition & avoid iatrogenic injury to teeth and tooth buds.

According to our study results we currently believe that fracture of the mandible in children can be effectively managed by Open Reduction And Internal Fixation with monocortical miniplates and screws , producing optimum outcomes with few or no complications.

The greatest advantages of ORIF are:-

Patient compliance

Prevention of Maxillo Mandibular Fixation

Early return to normal feeding and function

Bibliography

BIBLIOGRAPHY

1. A.B.vanAs,Causes and distribution of facial fractures in a group of south African children and the value of computed tomography in their assessment, Int.J.OralMaxillofac, Surg,2006;35:903-906.
2. Amaratunga NA de S.Fracture in children – a study of clinical aspects, treatment needs and complications. J. Oral Maxillofacial Surgery 46:637-640, 1988.
3. Anderson PJ. Fracture of the facial skeleton in children. Injury 1995 Jan 26 (1): 47-50.
4. Baby John, Management of mandibular body fractures in pediatric patients, Contemporary clinical dentistry oct-Dec 2010 Vol 1 Issue 4.
5. Barry L.Eppley, Use of resorbable plates and screws in pediatric facial fractures, Oral MaxillofacSurg 63:385-391,2005.
6. Beatrous WP. Tracheostomy (tracheotomy). Its expanded indication and present status based on an analysis of 1000 consecutive operations and a review of the recent literature. Laryngoscope78:3, 1968.
7. Becky L Age- Related Variations in injury, Arch Otolaryngol Head Neck Surg – Vol 116, January 1990

8. Berg S, Pape HD. Teeth in the fracture line. Int. J. Oral Maxillofac. Surg 1992 June: 21(3), 195-6.
9. Champy M, Lodde JP Schmitt R, Jacger JH, Muster D.Mandibular osteosynthesis by miniature screwed plates via a buccal approach. J.Maxillofacial Surgery 6:14-20, 1978.
10. Das U.M Nagarathan,2006 Management of facial trauma in children:- IndianSoc.Pedod .Prev .Dent .24,161-163
11. Enlow DH. Handbook of facial growth, 2nd ed, Philadelphia, WB Saunders Company, 1982.
12. Ferreira, Etiology and patterns of pediatric mandibular fractures in Portugal, Journal of craniofacial surgery: May 2004- Volume15-Issue 3-pp 384-391
13. Feller et al 2002 ,combination of microplates and miniplates for osteosynthesis of mandibular fractures .IJOMS 31,78-83
14. Fonseca Oral & Maxillofacial Surgery Trauma volume 3
15. George M. Kushner, Fractures of the growing mandible, Atlas oral maxillofacial surgclin N Am 17(2009)81-91.

16. Halling F, Merten HA, Luhr HG. Studies on mandibular fractures during the growth period and late results of surgical treatment. DtschZahnarZtl-Z 1990 Dec: 45(12): 809-12.

17. Hanna Thoren, changing trends in causes and patterns of facial fractures in children, oral surg oral med oral pathol oral radiolendod 2009;107:318-324.

18. Hardt N, GottSauner. The Sauner. The treatment of mandibular fractures in children. J Craniomaxillo fac. Surg 21 (5): 214-9-9, 1993.

19. Hunsuck E: Intraoral open reduction of fractured mandible. J.OralSurg, 13:807-812, 1984.

20. IoannisIatrou, surgical protocols and outcome for the treatment of maxillofacial fractures in children, Journal of carnio-maxillo-facial (2010)38,511-516.

21. J.L.Munante Cardenas, mandibular fractures in a group of Brazilian subjects under 18 years of age, I Journal of pediatric otorhinolaryngology 741 (2010)1276-1280.

22. Jones KH, Bauer BS and Pensler JM. Treatment of mandibular fractures in children. Ann Plast. Surg 23:280-283, 1989.

23. KaanC.Yerit, Biodegradable fixation of mandibular fractures in children: stability and early results, Oral surg oral med oral radiolendod 2005;100:17- 24

24. Kaban LB, Mulliken JB, Murray JE. Facial fractures in children. An analysis of 122 fracture in 109 patients. Plast. Reconstr. Surg. 59:15, 1977.

25. Klotch D: Use of rigid internal fixation in the repair of complex and complex and communicated mandibular fractures. OtolaryngolClin. North America 20:495-518, 1988.

26. Kruger G.Textbok of Oral Surgery, 2nd Ed. C.V. Mosby Co.1964.

27. MarianowskiRemi, Mandibular fractures in children long term results, international journal of pediatric otorhinolaryngology (2002) 2003,25-30

28. Marx RE. 15th Annual Oral and Maxillofacial Pathology review, Miami Florida, January, 18-22, 1992.

29. Michael B.Siegel, MD;RalphF.Wetmore, Mandibular Fractures in the Pediatric Patient, Arch Otolaryngol Head Neck Surg – Vol 117, May 1991

30. Michelet FY, Deymes J Dessus B. Osteosynthesis with miniaturized screwed plates in maxillofacial surgery. J. Oral and Maxillofacial Surgery I, 79-84, 1973.

31. NicoleM.Eggensperger, Pediatric Craniofacial trauma,J.Oral Maxillofac, Surg,66:58-64,2008.

32. Nixon F and Lowey HN. Failed eruption of the permanent canine following open reduction of a mandibular fracture in a child. Br.Dent. J. 168: 204-5, 1990.

33. Norholt,se., krishnan,v., sindent-pedersen ,s., 1993.pediatric condylar fractures .a long term follow –up study of 55 patients .j.oral maxillofacial surgery 51,1302-1309

34. Oji ,c., 1998 .fractures of the facial skeleton in children : a survey of patients under the age of 11 years .j craniomaxillofacial surgery.-26,322-325

35. Patrick Cole, principles of pediatric Mandibular fracture management, Plast. Reconstr.Surg.2009 Mar;123(3):1022-4.

36. Petterivaananen et al 2008 Fixation properties of a biodegradable free form osteosynthesis plate OOOOE 106,477-482

37. Posnick,J.C., 1993.pediatric facial fractures evolving patterns of treatment .j.oms.51,836-844

38. R.Bali ,Bone resorption after bioresorbable fixation of a fractured pediatric mandible,JO Oral Surgery 4,2011,48-50

39. Reitzik M, Schoort W. Bone repair in the mandible. A histologic and biometric comparison between rigid and semirigid fixation. J. Oral Maxillofacial Surg. 41; 215-218, 1983.

40. Richard H.Haug, university of Kentucky and metrohealth medical center, Vol. 90 No.2,August 2000.

41. Roslan Abdul Rahman, Maxillofacial truma of pediatric patients in Malaysia, International Journal of Pediatric Otorhinoplaryngology (2007) 71,929-936.

42. Rosenburg et al 1993,should titanium miniplates be removed after bone healing is complete IJOMS 22,185-188

43. Rowe NL. Fractures of the facial skeleton in children J.Oral Surgery 26:505-515, 1968.

44. Rowe and Williams Maxillofacial Injuries textbook volume 1

45. Rudolf R.M, treatment of pediatric facial fractures, oral maxillofacsurg 63:382-384,2005

46. Scott D Imahara, patterns and outcomes of pediatric facial fractures in the united states,J Am collSurg 2008;207:710-716.

47. SheratAtilgan, mandibular fractures, J Appl oral Scl. 17 2010; 18(1):17 -22.

48. Smart JM Jr, the pediatric mandible: I.A primer on growth and development, plastReconstr Surg.2005 jul; 116(1):14-23.

49. Steinhart H, Schroeder HG. Should Osteosynthesis plates in area of the facial skull be removed again? Results of experimental and clinical studies. HNO, 43(4): 211-5, 1995.

50. Steven P.Davidson, Pediatric Mandibular Fractures, Arch Facial Plastsurgjul-sep 2001 2001;3(3):185-189.

51. SudeshniNaidoo ,Child abuse & neglect vol,24,521-534,2000

52. Sunil Sharma, Pediatric mandibular fractures, international journal of clinical dentistry, May- August 2009;2(2):1-5.

53. Tamari R, Shimizu K, Murakami T Takahama, Yokota S.Management and subsequent 13 years 13 years progress of a mandibular fracture with malocclusion in a child-case report. J.OralRehabil. 18(2):193-202, 1991.

54. Tanaka N, Vehicle N, Suzuli K, TAshiro T, Tomitsuko K, Kumipma Y, Amagaso T. Maxillofacial fractures in children. J. Cranioxmillofac. Surg. 21(71):289-93, 1993.

55. TeomanEskitasciogul, Retrospective Analysis of two hundred thirty-five pediatric mandibular fractures cases.AnnPlastSurg**2009;63:522-530.**

56. Waldorn CW, Balkar SG. Fractures of the facial bones in children. J.OralSurg 1"215, 1943.

57. WalidA.Abdhullah, The use of a single titanium microplates in displaced pediatric parasymphysial mandibular fractures, the Saudi dental journal(2009) 21,95-100.

58. William C.Morgan oral Surgery, oral medicine,oral pathology,volume40, 3,september1975

59. Wong GB. Paediatric mandibular fracture treated by rigid internal fixation J. Can Dent. Assoc. 59 (9): 759-60, 763-4, 1993.

60. Zimmerman et al Pediatric facial fractures : recent advances in prevention and diagnosis IJOMS 2005 34,823-833.